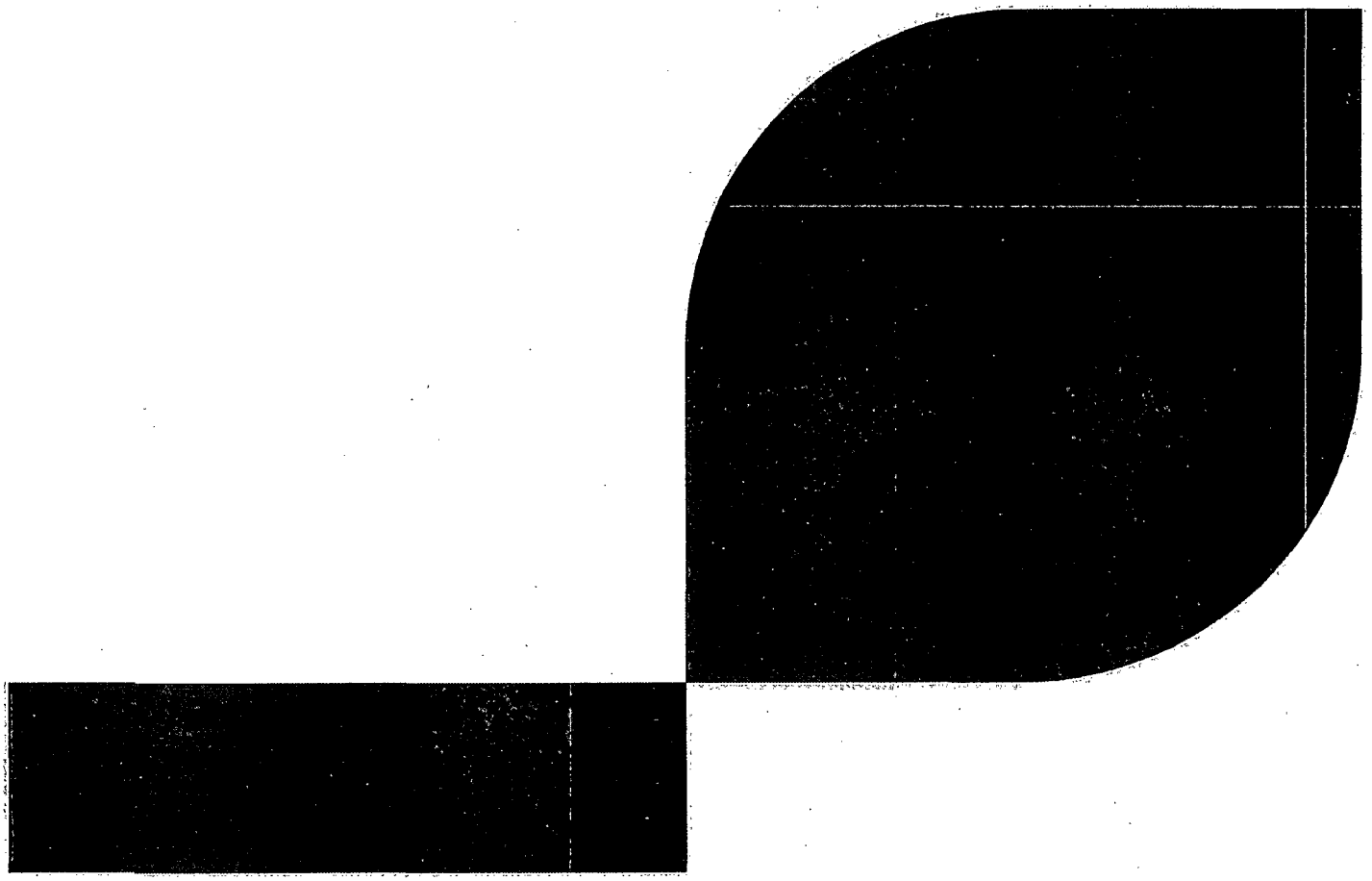

EMF-93-177(P)(A) Revision 1
Supplement 1(NP) Revision 0

Mechanical Design for BWR Fuel Channels Supplement 1: Advanced Methods for New Channel Designs

March 2010

AREVA NP Inc.

AREVA

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EMF-93-177(P)(A) Revision 1
Supplement 1(NP) Revision 0

Mechanical Design for BWR Fuel Channels Supplement 1: Advanced Methods for New Channel Designs

Nature of Changes

Item	Page	Description and Justification
1.	All	This is a new document.

Contents

Tables

Figures

This document contains a total of 14 pages.

Nomenclature

Acronym	Definition
AFC	Advanced Fuel Channel
BWR	boiling water reactor
EPRI	Electric Power Research Institute
EPU	extended power uprate
NRC	U. S. Nuclear Regulatory Commission
PIE	post-irradiation examination

1.0 INTRODUCTION

AREVA NP has developed a new BWR fuel channel design [

]. The AREVA NP fuel channel topical report (Reference 1) includes parameters and methods that must be updated in order to support this new channel design. These changes are detailed in this supplement.

This information is intended to be supplemental to the topical report. The existing information in Reference 1 is not being replaced by this document and may still be applied to current fuel channel designs.

2.0 FUEL CHANNEL DESIGN

The Reference 1 topical report describes typical fuel channel designs, as well as limiting parameters for any specific design. The general design of this fuel channel is similar to the designs described in the topical report: It is a square box with rounded corners that is open at the top and bottom ends. [

]

When providing additional information to the U.S. Nuclear Regulatory Commission (NRC) in Reference 2, AREVA NP identified a [ ] limit in order to define a range of applicability for the methods in the topical report. The new channel design [

].

3.0 FUEL CHANNEL BULGE ANALYSIS METHOD

Section 7.1 of the Reference 1 topical report describes an analysis method in which the channel stresses are calculated from [

].

The creep equations defined in Section 7.1 of the topical report are also being modified. This change is a general improvement and not directly tied to the new fuel channel design.

Creep deflection of the fuel channel is calculated in time steps, and the creep increments are accumulated over the residence life. [

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]. As shown in the figure, the creep model provides a conservative estimate of bulge.

4.0 STATISTICAL ANALYSIS OF CONTROL ROD INTERFERENCE

Section 7.2 of the topical report [

]

The control rod interference analysis method described in Section 7.3 of Reference 1 has been improved by [

]

For a specific [

]

5.0 SAMPLE EVALUATION RESULTS

Section 7.4 of the topical report presents a table of previous sample results from the control blade interference methodology. New sample problems have been prepared for the methodology and design changes described in this document. The sample results show typical results and do not limit the methodology to these specific cases. The channel evaluation methodology remains applicable to all BWR/3,4,5,6 reactor designs.

Table 1: Fuel Channel Deformation (Normal Operation)

[

]

The sample problems are not identical to those in the topical report due to changes in fuel channel designs and reactor operating conditions. The sample problems are representative of

current AREVA NP channel designs [

].

6.0 APPLICABILITY TO PRESENT CONDITIONS

Much of the methodology described in Reference 1 is not being changed, [

].

AREVA NP developed a state-of-the-art channel deformation measurement machine as part of the EPRI Fuel Reliability Program response to address emerging industry problems with abnormal channel bow (Reference 3). Through both EPRI-sponsored exams and additional PIE campaigns, AREVA NP has acquired a substantial amount of channel deformation data [

].

Another recent development is the move to 120% EPU operating conditions. A power uprate may lead to [

]. Therefore, the methodology used to calculate the margin to a stuck control blade remains conservative and is applicable to EPU conditions.

7.0 SUMMARY

The supplemental information provided in this document describes minor changes to the previous fuel channel design description, bulge evaluation model, and control rod interference analysis. This information does not replace any part of the Reference 1 topical report. Instead, the supplemental information allows for analysis of an optimized channel design that [

]. AREVA NP will design and license improved fuel designs as a result of an optimized fuel channel design.

8.0 REFERENCES

1. EMF-93-177(P)(A) Revision 1, *Mechanical Design for BWR Fuel Channels*, Framatome ANP Inc., August 2005.
2. Letter, Jerald S. Holm (FANP) to Document Control Desk (NRC), *Additional Information – EMF-93-177(P) Revision 1, "Mechanical Design for BWR Fuel Channels,"* NRC:05:028, Framatome ANP Inc., April 22, 2005.
3. *Poolside Measurement of AREVA BWR Fuel Channels*, EPRI, Palo Alto, CA: 2004. 1008097.

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Figure 1: Typical 100/71/51 AFC

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Figure 2: Calculated Versus Measured Bulge